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Though not bearing directly on the present subject, it is important to observe that Vulpian has succeeded in separately stimulating near their origin both the spinal accessory and the pneumogastric nerves. Excitement of the first named alone causes arrest of the heart, while both are able to set up movements in the stomach and other organs. Stimulation of the pneumogastric seemed to have no influence upon the circulation or the secretion of the mucous membrane of the stomach.—*Comptes Rendus, T. ci, p. 851.*

PSYCHOLOGY.

THE MATERIAL CONDITIONS OF MEMORY.—The greatest possible importance attaches to the question of the physical conditions of consciousness, but the investigation of it is surrounded with great difficulties. One of the most available points of approach is by a study of the characteristics of memory. Memory may be defined as *intermittent or recurrent consciousness;* and it follows that whatever produces or destroys memory is also a cause of the appearance or disappearance of consciousness. I refer especially to reminiscence, or the recurrent consciousness of a previous impression, as that part of memory which gives it its importance in this connection.

Memory is reasonably understood to be the result of an impression made on a physical basis of consciousness by some stimulus. The structure of this matter is affected, so that on the recurrence of consciousness within it, the consciousness takes the form or character of the modified structure it finds there. Important information as to the effects of different stimuli may therefore be gained by a consideration of their relative capacities for reproduction in the reminiscent phase of memory. On this point the following propositions may be considered:

There are two sources of impressions which reappear as memories; those from the subject or subjective activities of the mind, and those from objects or things external to the mind. Before considering these, it is necessary to guard against confounding the recollection of the occurrence of an event, with the recollection or reminiscence of the sensations which constituted that event. Thus one can remember that he reached some conclusion in a given discussion, but may be unable to remember the conclusion itself. He may remember that he was angry, but be quite unable to reproduce the passion. He may remember that he had a toothache, but may be unable to reproduce the suffering itself.

Subjective stimuli are of the two classes into which all mental acts fall, the intelligent and the emotional. Objective stimuli belong to the pains and pleasures of all parts of the body, and to the special and general senses. To what extent are all these phases of consciousness susceptible of reproduction in the reminiscent part of memory? There is a kind of memory not strictly reminiscent, which may be well termed, *recognition.* The difference

between reminiscence and recognition is this. In reminiscence the peculiar form of consciousness is actually reproduced, according to the law of associated ideas; in recognition the recurrence of the original stimulus is necessary to arouse memory; otherwise the sensation would not return to consciousness. The former is evidently the stronger and truer form of memory, and as it answers our purpose best, and is most easily examined, I confine my attention to it for the present.

This much being understood, it appears to me that the following propositions may be maintained:

I. That objective impressions are less profound than subjective, the capacity for reminiscence being the index.

II. That of the objective, those introduced by the special senses are more profound than those introduced by the general senses.

III. That of the former, those introduced by supposed vibrations (sound, sight) are more profound than those produced by supposed contact of matter (taste, smell).

IV. That of subjective impressions, those produced by acts of intelligence are more readily and exactly reproduced, than are those produced by the emotions.

These propositions might be illustrated at great length, but for the present I content myself with the following:

II. The pleasures and pains of general sensation cannot be reproduced by an act of memory. No one can reproduce any particular pain for instance. It is probable that pleasures and pains which are characteristic (locality being left out of account), can be more or less *recognized* on their recurrence, showing that they make a real, but comparatively slight impression on the physical basis ofconsciousness.

III. No one can reproduce a taste or a smell with the same degree of distinctness that is possible in the case of a sound or a sight. Most persons cannot reproduce them at all. As to sounds, the reproduction is very imperfect; and although the reproduction of visible objects is, in most people, more distinct, it is short of the reality of seeing.

IV. Mnemonic reproduction of an emotion is not difficult, but falls short of the emotion itself, even in the most pronounced cases. Although emotions leave behind them deep impressions, they are plainly evanescent, in some persons more so than in others. Nevertheless a reproduced emotion is more distinctly like the original than is a reproduced sight.

Of processes of the intelligence, those of the imagination are reproduced with great precision and clearness in most persons, but not more so than processes of reason. It is only in the intelligence that it is safe to say that the reproduction or reminiscence is identical with its original. It is true that the impression may be evanescent here also, but it is less so than in the case of an

emotion. It is only in bad mental health that association fails to revive completely a process of intelligence. It is a consequence of this fact that intelligence is more cumulative in its character than emotion, and much more so than pleasure or pain. Could we reproduce in our consciousness sights, sounds and sensations as truly as we do thoughts, we would be different beings from what we are. And were they cumulative in our consciousness in the same sense that thoughts are, we would be still more different.

Thus there seems to be a relation between the nature of stimuli and their effects on consciousness, which may perhaps be formulated as follows: *The persistence of an impression on the physical basis of consciousness is in inverse proportion to its intensity in consciousness.* Thus the most violent and least permanent of impressions are molar, as in physical sensations. The intermediate are those of such special senses as are supposed to be the result of exterior vibrations. The most delicate and the permanent, are those produced by the supposed extremely rapid vibrations of living brain-tissue. These create an accustomed channel of apparently greater perfection of construction than do the more violent forms of consciousness, which are therefore longer preserved, and more readily followed by new arrivals of consciousness. The reason for this is to be found in the probable fact, which is also supported by other considerations, that the more violent forms of consciousness destroy more tissue, while the most delicate forms destroy less, rendering rearrangement more easy.

These considerations are of course applicable only to new stimuli, which are not mere repetitions of old ones, and are especially not applicable to the secondary stimulus furnished by reminiscence itself, in which are to be included dreams. That the materials of thought are often only reminiscences is no objection to the theory here presented; for the processes, and conclusions of thought are perfectly new experiences when first performed and attained. And the precision with which intelligent thoughts are reproduced is a guarantee of their persistence, since each reminiscence acts in some degree as a new stimulus. This is true of the simplest processes of intelligence in the lowest types of mind.

We can derive some hints from these considerations, as to the evolution of temporary and permanent states of consciousness.—*E. D. Cope.*

ANTHROPOLOGY.[1]

Stone Plummets.—In the summer of 1884 Mr. H. W. Henshaw spent a portion of his vacation in Southwestern California, and while there was enabled to gather some information from the Santa Barbara Indians concerning the so-called stone plummets. They have been called sinkers, plummets, sling-shots, bolas, spinning-weights, fetishes and sorcery-stones. With reference to

[1] Edited by Prof. Otis T. Mason, National Museum, Washington, D. C.